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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification : Not classified

A2

(11) International Publication Number: **WO 99/31953**

(43) International Publication Date: 1 July 1999 (01.07.99)

(21) International Application Number: PCT/NZ98/00190

(22) International Filing Date: 23 December 1998 (23.12.98)

(30) Priority Data:
329490 23 December 1997 (23.12.97) NZ

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(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

Without international search report and to be republished upon receipt of that report.

(54) Title: SYSTEM FOR CREDIT TRANSFER AND LOAD CONTROL IN A POWER DISTRIBUTION NETWORK

(57) Abstract

A system is provided for transferring financial data from a utility supplier to a number of remote devices belonging to at least one consumer. The system comprises a financial data memory in which is stored financial data relating to consumers of a utility supplier; a number of remote devices, each device further comprising a receiver having a network address in a radio network and a device memory; and a controller arranged to retrieve from the financial data memory financial data relating to a consumer and to transmit the financial data as a message over the radio network to the network address of at least one remote device. Each device is arranged to receive the message transmitted by the controller over the radio network and to store in the device memory the financial data in the message where the network address of the message matches the network address of the receiver. A method is also provided for transferring financial data from a utility supplier to a number of remote devices belonging to at least one consumer.

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SYSTEM FOR CREDIT TRANSFER AND LOAD CONTROL IN A POWER DISTRIBUTION NETWORK

FIELD OF INVENTION

The present invention relates to a system and method for transferring financial and operating/configuration data from a utility supplier to a number of remote devices belonging to at least one consumer over a radio network. The devices may be provided with metering functions, or may interface to meters. The data includes credit and tariff data. The system may also transmit load control data over the network.

BACKGROUND OF INVENTION

Most suppliers of electricity, gas, water and other utilities provide their consumers with one or more devices which are installed at the consumer's premises. Typically the device is read by an officer of the utility supplier periodically to determine how much of the utility has been used. The consumer is then invoiced based on how much of the utility has been used at the relevant tariff rate.

In some payment schemes the device includes a memory to store credit data and tariff rates and the utility supplier may operate either a pre-payment or post-payment scheme. In pre-payment metering a payment is made for the utility by the consumer prior to its use. The consumer purchases credit and then may use the utility until the credit has expired. In post-payment metering the device has a maximum credit limit. When the credit limit is exceeded the device is cut off.

Consumers purchase either disposable magnetic stripe cards or a credit transfer number from vending stations at the utility supplier's office or agent which are then used by the consumer to add credit to the device at the consumer's premises.

SUMMARY OF INVENTION

In broad terms the invention comprises a system for transferring financial data from a utility supplier to a number of remote devices belonging to at least one consumer, the system comprising a financial data memory in which is stored financial data relating to consumers of a utility supplier; a number of remote devices, each device further comprising a receiver having a network address in a radio network and a device memory; and a controller arranged to retrieve from the financial data memory financial data relating to a consumer and to transmit the financial data as a message over the radio network to the network address of at least one remote device; wherein each device is arranged to receive the message transmitted by the controller over the radio network and to store in the device memory the financial data in the message where the network address of the message matches the network address of the receiver.

The invention in another form in broad terms comprises a method of transferring financial data from a utility supplier to a number of remote devices belonging to at least one consumer, the method comprising the steps of storing in a financial data memory financial data relating to consumers of a utility supplier; arranging a number of remote devices, each device further comprising a receiver having a network address in a radio network and a device memory; and retrieving from the financial data memory financial data relating to a consumer and transmitting the financial data as a message over the radio network to the network address of at least one remote device; wherein each device is arranged to receive the message transmitted by the controller over the radio network and to store in the device memory the financial data in the message where the network address of the message matches the network address of the receiver.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred form system and method of the invention will be further described with reference to the accompanying drawings by way of example only and without intending to be limiting, wherein:

Figure 1 is a block diagram of the system of the invention;

Figure 2 illustrates the format of messages sent in accordance with the known POCSAG paging protocol;

Figure 3 shows a message supplemented with addressing information in accordance with the proprietary protocol of the present invention;

Figure 4 shows a portion of the message illustrated in Figure 3; and

Figure 5 is a block diagram of a paging receiver of the invention connected to a device.

DESCRIPTION OF PREFERRED FORMS

The preferred form system 1 is shown in general block diagram form in Figure 1. Utility supplier 2 supplies a utility, for example electricity, gas and/or water to one or more consumers 4A, 4B and/or 4C. In return for supply of this utility the consumer generally makes payment to the utility supplier.

The consumer may have available a number of ways of making payment to the supplier or an agent of the supplier. For example the consumer may arrange a monetary transfer to the supplier from the consumer's bank account via an interactive voice recognition (IVR) system operated by the consumer's bank or the utility company. Alternatively, payment may be made by direct debit, regular or automatic payment from the consumer's bank account, or against a credit card account, for example. Alternatively the consumer may post payment to the supplier, may use a kiosk or service centre based system, or may use direct cash transfer. As a further alternative the supplier may be equipped with an EFTPOS terminal and consumer may visit the supplier and make payment.

Data relating to each consumer is stored in a memory 6 which may be maintained by controller 8. The preferred memory 6 has stored in it financial data relating to each consumer. Examples of financial data include the amount of the utility used by the consumer but not yet paid for, the appropriate tariff rate for the consumer's use of the utility, and payment the consumer may have made in advance for supply of the utility.

The controller 8 retrieves from memory 6 financial data relating to a particular consumer and as will be more particularly described, transmits the financial data to devices 10A, 10B and/or 10C of consumers 4A, 4B and 4C. The devices may be provided with metering functions, or may interface to meters. The financial data may be credit data or tariff rates to store in an individual device.

The preferred form controller 8 is arranged to send financial data retrieved from memory 6 as one or more messages over a radio network. The preferred form radio network is a paging network 12. It will be appreciated that other suitable radio networks could be used, for example cellular or satellite networks.

As will be more particularly described, each device 10 has a network address, called a RIC (receiver identification code) in the paging network 12. The controller 8 attaches the network address of a device to the financial data intended for that device and transmits the data as a message over the paging network 12 to that device. In this way credit data and tariff data may be transferred from the utility supplier 2 to remote devices belonging to a consumer.

The preferred form system 1 uses a public domain paging protocol. Examples of such known protocols in the public domain include POCSAG, Swedish Format (MBS), the Radio Data System (RDS) format and the European Radio Message System (ERMES) format. Another protocol which may be used is the FLEX™ proprietary protocol. POCSAG and FLEX™ protocols are preferred, although other protocols may be used depending on suitability in particular geographic regions.

The operation of the system will be further described with reference to the POCSAG protocol, illustrated in Figure 2. The POCSAG protocol supports 512, 1200 and 2400 baud rates. A POCSAG transmission consists of a 576-bit preamble code 18 that is used to "wake up" pagers that are in a battery-saver mode. A batch of pages consist of a synchronisation code 20 followed by eight data packets, one of which is illustrated as 22. Each packet 22 is a fixed number of bits that begins at a fixed time duration after the transmission of the sync code 20. Each packet 22 is transmitted back to back following the sync code. After the eighth packet is transmitted, the next batch consisting of a sync code and eight more packets can be sent. A paging message comprises one or more packets addressed to the same network address.

Financial data is sent to a particular device by attaching the network address or RIC 24 to the financial data formatted as message data 26, and sending the RIC and message data as a packet 22 conforming to the POCSAG paging protocol. The message data 26 is encoded and transmitted in fixed blocks, known as "code words", starting directly after the RIC 24 in each data packet 22. The RIC 24 and message data 26 each have an error detection and correction code associated with them to detect small error bursts and to correct single bit errors that may occur.

It is envisaged that a device may share the same network address with one or more other devices. For example, in Figure 1, device 10A could share the same network address as device 10B while device 10C may have a different address. By sending a message to the network address common to devices 10A and 10B, the controller 8 may with one message send financial data to both devices. In this way messages can be addressed to an individual device or all devices having the same network address.

The system 2 further provides for devices having a common network address to be addressed either globally, individually, or as a group. Each device 10 is allocated an individual device identification code. The preferred codes are selected so that each device needing to be addressed individually has an individual device identification code which differs from the codes of other devices having the same network address.

Figure 3 illustrates the format of a data packet 28 of the present system 2. Each packet 28 is variable length with a maximum size of 82 bytes. The preferred packet size is 61 to 81 bytes. Each packet 28 contains a network address or RIC 24A which is typically 6 bytes in length, and message data 26A. The message data 26A in turn comprises a device identifier 32, a financial data block 33 and a check sum 40.

Device identifier 32 is shown in block schematic form in Figure 4. The device identifier 32 preferably comprises a message type (T) having notional values 1 - 3 and device address (A). Where T=1, A will have no value, and the message is sent to every device having the same network address. Where T=2, the message is addressed to an individual device, and A will represent the individual device identification code of that device. Where T=3, the message is addressed to a group of receivers, and A will represent the group of devices.

In this way the controller 8 may send messages to an individual device, a group of devices having the same network address, or all devices having the same network address. The controller 8 maintains a queue of messages to be delivered over the paging network 12. Messages are delivered to the network 12 on a strictly first in first out basis. Controller 8 will continue to attempt to send the first message in the queue until success is achieved. If the first message cannot be sent due to problems then the entire queue will be held up.

The preferred form controller 8 either comprises or is interfaced to a dynamic link library (DLL) containing routines (not shown). The controller including the DLL are designed to run under Microsoft Windows NT v 4.0. The software is not designed to be used re-entrantly, that is a second call to routines in the DLL is not permitted until the first call has returned. The controller 8 is designed to reject messages if they cannot be delivered to the paging network 12 for any reason.

The controller 8 uses the following programmed functions:

SendPage (messageID, type, address, data)

Returns:

-1 on error if controller 8 is not running

Individual messages are placed in the queue by this function. There is no need for the function to return -2 for the first call because there is no issue with messages in the queue being lost. Each message is explicitly confirmed as being in the queue, sent and waiting confirmation, sent and confirmed.

GetStatus(messageID)

Returns:

-1 on error if controller 8 is not running

1 if message waiting in the queue

2 if successfully delivered to the paging network 8, awaiting confirmation

3 if confirmed by receiver

4 if deleted by operator

0 if message ID is unknown

Controller 8 keeps the status of each message. Repeated calls for a specific message will return the same value except for value=3. When the controller receives confirmation that a message has been sent, the controller deletes information regarding this message ID from its message list. The value of 3 will be returned once only. Subsequent calls to GetStatus() for this ID will return 0. If the value 3 is not returned for whatever reason the controller cannot assume that the message has been sent and confirmed. The message should then be resent.

InQueue()

Returns:

the number of messages in the queue

TLPQuit()

Returns:

-1 on error if encoder 6 is not running

This function instructs the encoder 6 to quit.

TLPVer()

Returns:

the version multiplied by 100 of the DLL as integer. This does not communicate with the controller 8.

The controller 8 writes to a log file (not shown) which contains a transcript of all operations including attempts to start with incorrect installation. If the controller 8 detects an error it writes the error to the log file and quits. Typical errors include the following:

- COM port open by another
- modem not responding
- paging network 8 not responding
- out of memory
- disk full
- incorrect data from DLL
- COM port doesn't exist

The above errors mean that the controller 8 cannot perform its function and so should abort so that SendPage(...) returns an error notifying the controller that paging is not available.

The preferred form device 10A is shown diagrammatically in Figure 5. The preferred form device 10A is interfaced to a pager board 50 through a processor unit 52. The pager board 50 will be configured differently for the specific paging network for which it is designed to work. The preferred form pager board is configured for the POCSAG protocol as described above. Each pager board 50 is configured with a network address or RIC.

The processor unit 52 in turn comprises a programmable microprocessor 54, a device memory 56, a clock/calendar 58 and battery 60. An individual device identification code is stored in the device memory 56. Also stored in the device memory 56 may be the stored credit value for device 10 and the appropriate tariff rate for the consumer's us of the utility.

In use the pager board 50 receives messages from the paging network 12 where the network address of the message matches the network address of the pager board 50. These messages are decoded by the pager board 50 and delivered to the processor unit 52 as a serial data stream. The processor unit 52 interprets each message using software programmed for the purpose and compares the device identifier information in the message with the device identification code of the device 10A stored in memory 56. If there is a match the unit 52 passes the information in the message to the device 10A.

The messages may contain credit data, in which case the device 10A receives a certain amount of credit for the particular utility. The message may alternatively contain tariff data in which case the tariff data of the device stored in the memory 56 is replaced with the tariff data sent in the message.

The preferred processor unit 52 is interfaced to a display 62 which may, for example, display to the consumer information regarding the appropriate tariff rate, the amount of credit available in the device 10A, or provide warnings where credit has been exceeded.

It is also envisaged that controller 8 may be arranged to transmit load control data over the network 12. Transmission of load control information in this way is a substitute for conventional ripple control and also whereby the supplier may disconnect the consumer remotely from the utility service if, for example, the consumer's credit has run out. Load control commands which may be sent over the system may include:

- Switch a load on/off
- Switch a load on/off at time T
- Switch a load on/off at a random time over a period (eg. Next five minutes)
- Set time/date
- Assign a load to shed at frequency F (eg. 48 Hertz) after a delay D (eg. 1 second)

- The remote controller 5 may also be configured to switch on/off a load during a certain programmed tariff period, which may be updated periodically

In a further preferred form the controller 8 may send operating or configuration data over the network 12. For example, the controller 8 may remotely reprogram the individual device identification code of a device. In another preferred form the controller 8 may send ASCII text to display to the consumer text messages. These text messages could relating to tariff rates or credit, or may provide the consumer with information regarding future pricing options.

It will be apparent to the skilled reader that the invention provides a system where a single pager network address or RIC may be allocated to a number of different devices. Transfer of financial data (such as credit or tariff data) and transfer of load control and other commands may be conducted over a paging network where data and/or commands may be sent to one or more devices using a single message thereby reducing the bandwidth required.

The foregoing describes the invention including a preferred form thereof. Alterations and modifications as will be obvious to those skilled in the art are intended to be incorporated within the scope hereof as defined by the accompanying claims.

CLAIMS

1. A system for transferring financial data from a utility supplier to a number of remote devices belonging to at least one consumer, the system comprising:

a financial data memory in which is stored financial data relating to consumers of a utility supplier;

a number of remote devices, each device further comprising a receiver having a network address in a radio network and a device memory; and

a controller arranged to retrieve from the financial data memory financial data relating to a consumer and to transmit the financial data as a message over the radio network to the network address of at least one remote device;

wherein each device is arranged to receive the message transmitted by the controller over the radio network and to store in the device memory the financial data in the message where the network address of the message matches the network address of the receiver.

2. A system as claimed in claim 1 wherein the receiver of each device shares a network address with the receiver of one or more other devices and each device further comprises an individual device identification code.

3. A system as claimed in claim 2 wherein each message includes a device identifier to specify whether the message is addressed to an individual device, more than one device having the same network address or all devices having the same network address.

4. A system as claimed in claim 3 wherein each device further comprises a microprocessor arranged to receive the message from the receiver and to store in the device memory the financial data in the message only if both the addressing data of the message matches the network address of the receiver and if the device identifier of the message matches the individual device identification code of the device.

5. A system as claimed in any one of claims 1 to 4 wherein the financial data transmitted over the radio network includes credit data.

6. A system as claimed in any one of claims 1 to 5 wherein the financial data transmitted over the radio network includes tariff data.

7. A system as claimed in any one of claims 1 to 6 wherein the controller is also arranged to transmit load control data over the radio network and each device is arranged to receive and act on the load control data.

8. A system as claimed in any one of claims 1 to 7 wherein the controller is also arranged to transmit operation and/or configuration data over the radio network and each device is arranged to receive and act on the operation and/or configuration data.

9. A system as claimed in any one of claims 1 to 8 wherein the controller is also arranged to transmit text over the radio network and each device is arranged to receive and act on the text.

10. A system as claimed in any one of claims 1 to 9 wherein the radio network comprises a paging network.

11. A system as claimed in any one of claims 1 to 9 wherein the radio network comprises a cellular network.

12. A system as claimed in any one of claims 1 to 9 wherein the radio network comprises a satellite network.

13. A system for transferring financial data from a utility supplier to a number of remote devices having stored credit values belonging to at least one consumer, substantially as herein described with reference to any one of Figures 1, 3, 4 and 5.

14. A method of transferring financial data from a utility supplier to a number of remote devices belonging to at least one consumer, the method comprising the steps of:

storing in a financial data memory financial data relating to consumers of a utility supplier;

arranging a number of remote devices, each device further comprising a receiver having a network address in a radio network and a device memory; and

retrieving from the financial data memory financial data relating to a consumer and transmitting the financial data as a message over the radio network to the network address of at least one remote device;

wherein each device is arranged to receive the message transmitted by the controller over the radio network and to store in the device memory the financial data in the message where the network address of the message matches the network address of the receiver.

15. A method as claimed in claim 14 wherein the receiver of each device shares a network address with the receiver of one or more other devices and each device further comprises an individual device identification code.

16. A method as claimed in claim 15 wherein each message includes a device identifier to specify whether the message is addressed to an individual device, more than one device having the same network address or all devices having the same network address.

17. A method as claimed in claim 16 wherein each device further comprises a microprocessor arranged to receive the message from the receiver and to store in the device memory the financial data in the message only if both the addressing data of the message matches the network address of the receiver and if the device identifier of the message matches the individual device identification code of the device.

18. A method as claimed in any one of claims 14 to 17 wherein the financial data transmitted over the radio network includes credit data.

19. A method as claimed in any one of claims 14 to 18 wherein the financial data transmitted over the radio network includes tariff data.

20. A method as claimed in any one of claims 14 to 19 wherein the controller is also arranged to transmit load control data over the radio network and each device is arranged to receive and act on the load control data.

21. A method as claimed in any one of claims 14 to 20 wherein the controller is also arranged to transmit operation and/or configuration data over the radio network and each device is arranged to receive and act on the operation and/or configuration data.

22. A method as claimed in any one of claims 14 to 21 wherein the controller is also arranged to transmit text over the radio network and each device is arranged to receive and act on the text.

23. A method as claimed in any one of claims 14 to 22 wherein the radio network comprises a paging network.

24. A method as claimed in any one of claims 14 to 22 wherein the radio network comprises a cellular network.

25. A method as claimed in any one of claims 14 to 22 wherein the radio network comprises a satellite network.

26. A method of transferring financial data from a utility supplier to a number of remote devices having stored credit values belonging to at least one consumer, substantially as herein described with reference to any one of Figures 1, 3, 4 and 5.

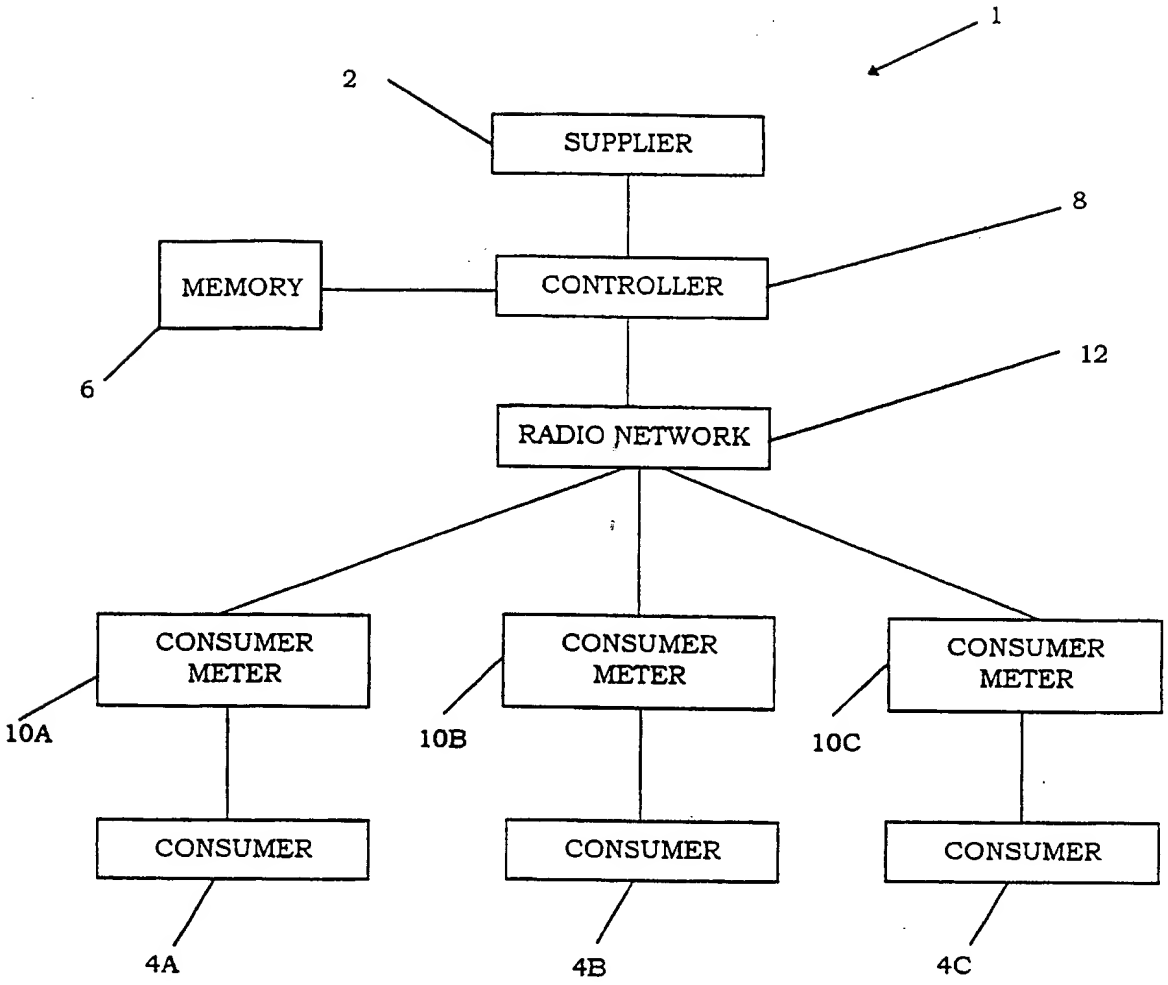
1
2
SUPPLIER
8
MEMORY
CONTROLLER
6
12
RADIO NETWORK
CONSUMER METER
CONSUMER METER
CONSUMER METER
10A
10B
10C
CONSUMER
CONSUMER
CONSUMER
4A
4B
4C

Figure 1

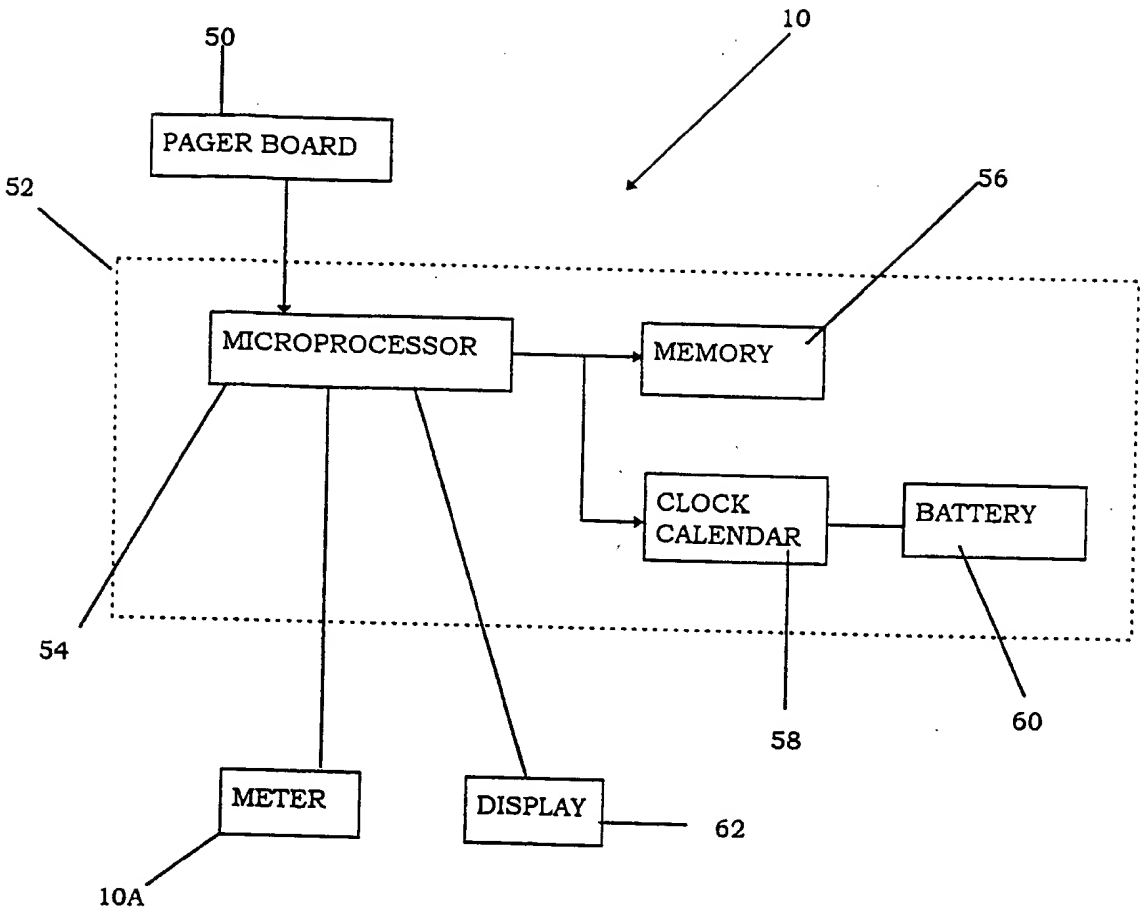
50
10
PAGER BOARD
52
56
MICROPROCESSOR
MEMORY
CLOCK
CALENDAR
BATTERY
54
58
60
METER
DISPLAY
62
10A

Figure 5